2005 Salt Lake City Annual Meeting (October 16–19, 2005)

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HYDROGEOLOGIC SENSITIVITY ANALYSIS OF A HETEROGENEOUS FACIES MODEL OF AN ALLUVIAL AQUIFER IN THE EASTERN SAN JOAQUIN VALLEY, CALIFORNIA

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Heterogeneous sediments from Cenozoic alluvial fan sequences create complex hydraulic conductivity distributions in the eastern San Joaquin Valley, California. To accurately simulate flow and solute transport through such a complex aquifer system, researchers have developed sedimentary facies models to represent the hydraulic conductivity distribution. In this study, three different approaches were used to evaluate model sensitivity: 1) sensitivity to the geologic-transition probability model, 2) sensitivity to the hydraulic conductivity of individual facies, and, 3) sensitivity to the classification of sediments into facies categories.

Aquifer sediment heterogeneity was quantified by analyzing cores, cuttings, and geophysical logs, and grouping sediments into conductivity categories based on sedimentary facies. A geologic model of the complex hydraulic conductivity distribution was then produced using the program TPROGS. Using Markov chains to develop transition probabilities on the basis of stratigraphy, this program creates multiple equiprobable realizations of subsurface heterogeneity, yet changing the placement and connectivity of sand channels and local confining units. This significantly influences flow and solute transport for the chosen realization.

The hydraulic conductivity of intermediate facies such as fine sand or muddy sand, which make up about 30% of aquifer sediments, was estimated using slug tests, aquifer tests, falling head tests, and borehole flowmeter tests. These tests yielded a broad range (four orders of magnitude) of hydraulic conductivities. Such a range will affect overall flow and transport simulation results.

Lastly, this analysis looks at how the number of sedimentary facies categories influences model results. The number of categories chosen for the geologic model potentially influences important physical-attribute distributions, which may alter the simulated local transport of solute through the model. It is ideal to model the subsurface with the most detail available; however, sensitivity analysis may show that if computer time to run the model is limited or other practical restrictions exist, less than the optimal number of categories may be adequate to represent the heterogeneity of the aquifer system.

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General Information for this Meeting

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